



Space Launch and Transportation Systems (SLTS): Design and Operations

—An Integrated, Systematic Approach

Workshop Description

This workshop provides an integrated view of space launch and transportation systems design and operations, from customer needs, objectives and requirements, through launch and transportation system design, development, test and manufacturing to creating operations concepts and infrastructure capabilities. Lifecycle cost and the business case will be assessed. The thrust of the workshop is to identify technical risk and mitigate it in the most cost-effective manner, while maintaining the technical integrity of the vehicle(s) and infrastructure.

The workshop summarizes and amplifies on the efforts of 67 industry and government professionals with over 1000 years—10 Centuries—of collective experience that examined SLaTS design, reducing cost, and cost-effective launch operations. The workshop is packed with wisdom that the space industry has gained over the last 20-25 years of launch activities, including expendable, unmanned as well as reusable, crewed vehicles.

The workshop is based upon a primary reference that boils down the knowledge and wisdom that industry and government have in the SLaTS arena. This reference was sponsored by virtually every DoD and NASA organization that conducts space-related activities—**operations, use, design and development**.

The presenters of this exhaustive material are the people that wrote or edited the references. They are able to boil down the essence of the material for your future use and facilitate discussions that help you understand it and obtain maximum benefit.

In the workshop you will take a fresh look at space launch and transportation systems by emphasizing a process-oriented approach for creating cost-effective concepts to meet customer needs and objectives. The process describes how to translate SLaTS objectives, requirements, and constraints into viable and cost-effective operations concepts. Discussions on vehicle design present practical, detailed approaches and tools to analyze and design manned

and unmanned, reusable and expendable vehicles for

Earth and other planets, including architecture and configuration, payloads, and vehicle subsystems.

Workshop presentations on launch operations describe the functions to be performed, define and evaluate the key issues, help you develop an appropriate operations concept, and assess the complexity and cost of operations. Special emphasis is placed on describing the interrelationships and tradeoffs between system design and launch operations that must occur during the early stages of planning in order to deliver effective systems.

This is a ***hands-on workshop*** that focuses on helping you apply the information and processes presented once you return to your job.

Who Should Attend

This course is designed for a variety of space professionals who must interact with one another to produce, operate and use cost-effective space launch and transportation systems. Participants should include *managers* of all types, launch and transportation systems and subsystem *engineers, designers, analysts, operators* and *users* of launch systems. The material is especially useful to system engineers and project managers of new and existing systems.

Workshop Materials

Each participant will receive a copy of *Space Launch and Transportations Systems: Design and Operations*, by Kirkpatrick, Larson, Ryan and Weyers, and a complete set of course notes.

Workshop Presenters and Facilitators

Dr. Wiley Larson is editor and co-author of nine references on space and managing editor of the Space Technology Series. His focus is on providing useful references and tools for practicing space professionals. He also serves as Visiting Professor at the USAF Academy and Univ. of Delft. Dr. Larson has over 23 years' experience in space launch, satellite integration and testing, and space mission design. He has provided consultation for many government and industry organizations and taught hundreds of workshops and thousands of people.



Dr. Doug Kirkpatrick, Colonel, retired, USAF, retired, and former head of the Department of Astronautics at the U. S. Air Force Academy, was a contributing editor and author of *Space Launch and Transportation Systems: Design and Operations, and Understanding Space*. He has over 30 years' experience in the aerospace engineering arena.

Workshop Outline

This one-of-a-kind workshop focuses on creating a sufficient Phase "A" conceptual design of space launch and transportation systems..

Introduction

- Overview of Workshop
- Space Launch and Transportation Systems Design Process

Creating Alternative Space Launch and Transportation System Concepts and Architectures

- Understanding Requirements and Constraints
- Estimating the Energy Required to Meet Requirements
- Creating Alternative Missions and Systems
- Creating and Assessing Launch and Flight Operations Concepts
- Developing and Assessing Launch Facilities and Their Impact on Vehicle Design
- Assessing Alternative Manufacturing and Transportation Options
- Assessing Compatibility of the Vehicle with Overall Infrastructure

The Operating Environment—Hazards and Mitigation Techniques

- The Natural Space Environment
- Natural Surface Environments
- Induced Environments

Launch Vehicle Conceptual Design

- Characterizing the Vehicle Concept
- Estimating Propulsion Characteristics and Weight
- Assessing Aerodynamic Aspects
- Assessing Performance and Performing Mission Analysis
- Creating an Initial Vehicle Configuration

- Performing Sensitivity Analysis and Iteration
- Getting to the Numbers in an Example

Launch Operations Concept and Architecture

- Creating Launch/Landing Operations Concepts
- Identifying Functions to be Performed
- Assessing Potential and Existing Launch Sites
- Rationalizing Launch Concept with Vehicle Design
- Estimating Resources Required for Launch Operations

The System Engineering Process for SLATS Development and Operations

- Reviewing Requirements, Constraints and Concepts
- Developing Natural Environment Models
- Performing Functional Analysis and Developing Initial Trajectories
- Creating the Initial NGC Concepts
- Identifying and Quantifying Induced Environments
- Creating Subsystem Requirements and Allocation
- Managing the Trade Process
- Documenting the Refined Vehicle Baseline—Key Budgets and Configuration Items

Subsystems—Basic Principles, Options, Sizing and Application

- Propulsion
- Thermal Control
- Environmental Control and Life Support
- Crew Accommodations
- Navigation, Guidance and Control
- Power
- Structures and Mechanisms
- Avionics
- Computer Systems

Special Topics

- Manufacturing, Transportation and Logistics
- The Regulatory Environment
- Estimating Lifecycle Cost of SLATS
- The Business Case—Does it Close?

Integrating Examples

- Space Transportation System
- Partially Reusable Two-Stage Launch System